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A View and Section of the
Rock Spring at Saratoga, the dotted
lines shewing its inner cavity, and the
cross line, the surface of the water.
J. S. Swan

Published by

Albany

Valentine Seaman
A
DISSERTATION

ON THE
MINERAL WATERS OF SARATOGA.

INCLUDING AN ACCOUNT OF THE
WATERS OF BALLSTON.

Second Edition.....Enlarged.

By VALENTINE SEAMAN, M. D.

One of the Surgeons of the New-York Hospital.

" What dire necessities on every hand
" Our art, our strength, our fortitude require !
" Of foes intestine what a numerous band
" Against this little throb of life conspire !
" Yet *Science* can elude their fatal ire
" Awhile, and turn aside death's level'd dart,
" Soothe the sharp pang, allay the fever's fire,
" And brace the nerves once more, and cheer the heart,
" And yet a few soft nights and balmy days impart."

NEW-YORK :

Printed and Sold by Collins & Perkins, No. 189 Pearl-street.

1809.

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Washington, D.C.

TO
JOHN COAKLEY LETTSOM,
M. & L. L. D. &c.

IT is hoped that one whose life has been so conspicuously devoted to the diffusion of useful knowledge, in the promotion of human happiness, and whose *beneficent* exertions, unlimited by the boundaries of his own country, have been so sensibly extended to this, will not view with indifference, an attempt to investigate the real nature of the most celebrated of its medicinal waters. Indeed the lively interest he has manifested, as the *naturalist's* compa-
ni-

on, in researches of this kind, is an almost sure pledge of his approbation.

Under these impressions, the following pages are, with due consideration, respectfully inscribed, by his friend,

THE AUTHOR.

New-York, 6 Mo. 1809.

INTRODUCTION.

IT was a remark of the celebrated Bergman, that “ In all ages good Physicians, desirous of establishing the salutary art, on a firm foundation, have considered it incumbent on them, to submit to chemical analysis, such waters as were famous for the cure of any disease.” And indeed it is with justice expected of every physician, that at least he will enquire into the virtues of such substances, as shall offer themselves to his observation, supposed to possess active medicinal qualities: for “ The Lord hath created medicines

out of the earth, and he that is wise will not abhor them." And as there still remain diseases, which raise up their reproachful heads, in obstinate defiance of our art, it is more especially our duty to search out means for their destruction: for it is not consistent with our ideas of the goodness of the Deity, to suppose that he would have permitted the favourites of his creation to be afflicted with diseases, without having formed remedies for their relief: but for them, as for relief from spiritual evils, *we must seek, and we shall find.*

What a glorious era will the present time exhibit in the history of medicine; for beside the many other late improvements in the

practice of physick, the single establishment of Vaccination alone, has afforded more unblemished comfort to suffering humanity, than any other discovery ever made by the profession. For before that period, even where Inoculation for the Small Pox was, not only tolerated, but encouraged, as for instance in this city, more than one tenth part of all the persons that died, sunk under the immediate effects of that most loathsome of human maladies*. What a stimulus this is to

* By a register kept by the Sexton superintending the large cemetery in Broadway, it appears that during the fifteen years immediately preceding the introduction of Vaccination into New-York, of 5756 persons that were interred in that ground, 610 died with the Small Pox.

a perseverance in our researches ;— for who, twenty years ago, could have believed that the susceptibility to Small Pox, which seemed an immovable intailment upon human life, would have been so easily corrected.

American physicians, in particular, from their being situated in a country, with respect to medical researches, almost unexplored, should consider it doubly incumbent on them, to attend to its productions ; for besides the Ipecacuanha, the Snake Root, the Jalap, and many other useful remedies, America has also already furnished a *Bark* which has removed the fatality of that disease which in less than forty years deprived Britain of two of its mo-

narchs*. And “ Who knows but that at the foot of the Allegany Mountains, there blooms a flower that is an infallible cure for the epilepsy? Perhaps on the Monongahela, or the Potomack, there may grow a root, that shall supply, by its tonic power, the invigorating effects of the savage or military life, in the cure of consumptions.†” — And why may there not spring up a water, in some neglected valley, whose solvent quality may melt down the torturing stone, or whose penetrating influence may wash a-

* The intermittent fever, which is now considered a trivial complaint, was arranged in the class of incurable diseases, till the discovery of the Peruvian Bark. James the First, and Oliver Cromwell, both died of this complaint.

† Dr. Rush’s concluding lecture.

way the scrofula or eradicate the cancer from the system.

What funds of useful knowledge may there still be reserved for the discovery of Americans; since it was for them to check the fatal career of the scarlatina anginosa*; and also to loosen the fixed jaw, and relax the rigid muscles of the tetanus†.

Why may we not hope that some other of our countrymen may be fortunate enough, still further to diminish the list of those diseases

† The late Dr. Ogden, of Jamaica, Long-Island, was the person, who first introduced the use of Calomel, in this complaint; before which, its fatality among children was unparalleled, by any disease to which they are liable.

* We are indebted to Dr. Rush, for erasing this from the list of incurable diseases.

which yet continue to elude the power of medicine?

These reflections prevailed upon me, notwithstanding attendant difficulties*, to attempt to ascertain the composition of the Mineral Waters of Saratoga. Whether I have fully succeeded or not, my experiments, (which are inserted at full length for that purpose) with the skilful chemist will determine. In the mean time, not doubting but that his knowledge of the intricacy of the subject will secure, from the severity of censure, the little inaccuracies he may detect, particularly

* The most able professors in Europe say, that "The analysis of mineral waters, is justly considered one of the most difficult problems in chemistry.

when he considers, that in this work I have acted in the dangerous and toilsome capacity of a pioneer, opening a way to the analysis of these waters, whereby others may follow on, perhaps with more success, at least with less difficulty*.

It has been my intention to render this treatise as generally useful as possible. I have, therefore, in addition to the present accurate terms of the new nomenclature, given the more common names of such substances as have occurred in

* No one has heretofore attempted to analyse these waters: all that has been done was a mere enquiry into the air discharged from them: see Dr. Mitchill's experiments, related in the American Museum, Vol. 4. This is the first attempt made to search into their real substance, to ascertain the ingredients of their composition.

the course of the work : and have also, in other respects, employed as familiar a language as the nature of the subject would admit of ; and as in compositions of this kind, beauty of stile is of less consequence than perspicuity of expression, I doubt not but that the reader will excuse me, if he finds sentences which might have been more elegantly expressed.

Whether water, of itself considered, is a simple elementary substance, according to the opinion of the ancients, or a compound, as believed by most of the moderns (though perhaps well deserving of attention) is not the business of this dissertation to determine ; its views being confined, merely to discover the na-

ture of such mineral substances as are often dissolved in it, and to which many waters owe their particular medicinal virtues.

Such mineral waters have been noticed as far back as the time of *Hippocrates*. *Pliny* mentions certain of them, as possessing medicinal properties ; but we do not find any account of a method to detect their composition, till about the middle of the seventeenth century, when *Boyle* first observed, that the infusion of vegetable blues, was an accurate test for discovering the presence of uncombined acids or alkalis, by becoming red with the former, and green with the latter. He afterwards found out many other substances for the more full examination of waters.

During the time that *Boyle* was employed in these researches, *Duclos* was busy in the analysis of the waters of France, and made several improvements, by the addition of galls, and the tincture of turnsol, to our stock of reagents. *Hierne*, *Valerius*, *Boulduc*, and many other eminent chemists, continued to render this branch of science more perfect.

In the beginning of the present century, *Hoffman*, followed by *Springsfeld* and *Venel*, paid particular attention to what they called the mineral spirit of waters, and which since, by Dr. Priestly, has been proved to be the carbonic acid gas, or fixed air, as he termed it.

The mode of analysing waters has

been continually improving, since the first experiments of *Boyle*, till at length the celebrated *Bergman* has given the finishing stroke of its present perfection.

In examining these waters, I have proceeded first by reagents, to ascertain the different ingredients in their composition ; for notwithstanding some authors consider these as mere amusing experiments, yet I rather suppose them very useful for that purpose, particularly when employed in the extensive way that has been done in this enquiry ; and I fancy every intelligent reader will agree with me, upon a candid perusal of them. It must be acknowledged that we are thereby only enabled to discover the different in-

gredients of mineral waters, but not the proportion of each. It became, therefore, necessary to apply to distillation, to obtain the proportions of their aerial, and to evaporation and chrystalization, that of their fixed principles.

In the present edition, besides giving a plan of the furrounding country, and the relative situation of the Springs at Saratoga and Ballston, as taken from De Witt's Map of the State, I have also exhibited a view of the *Rock Spring* at Saratoga ; hoping thereby to assist in giving it a proper station among the extraordinary productions of our country. The more we reflect upon it, the more we must be convinced of the important place this rock ought to

hold among the wonderful works of nature. Had it stood upon the borders of the *Lago d'agnano*, the noted *Grotto del cani** (which burdens almost every book which treats upon the carbonic acid gas, since the peculiar properties of that air has been known), would have remained an obscure cleft in a rock, and if noticed at all, would never have been heard of beyond the environs of

* The carbonic acid gas in this cavern, notwithstanding its being stated by some as forming a stratum about knee high, and by others as rising a foot from the surface of the floor, does not in fact, or at least did not when I visited it in 1803, rise above a few inches from the ground; even so as to make it necessary for the person who attended to shew the experiments, to seek out some hollow place to extinguish the torch used upon the occasion, and also for him to force down the nose of his dog very near the ground, to exhibit its noxious

Naples ; while this fountain, in its place, would have been *deservedly* celebrated in story, and spread upon canvass, to the admiration of the world, as one of its greatest curiosities.

As an object of admiration the Grotto del cani can no more bear a comparison with the Rock at Saratoga, than the Water Falls of Tivoli could with the Cataract of Niaga-

effects upon animal life : nor indeed did the natural situation of the place at that time, admit of its being otherwise, for the bottom of it, if not descending from its inner extremity towards its mouth, was at most not more than upon a level, and from its mouth outwards the adjoining ground was very considerably descending. Hence we can hardly conceive but that this air, which is about 50 per cent heavier than the air of the atmosphere, would necessarily flow out, before it could rise to such a height.

ra, or the Lake of Avernus (the Tartarus of Virgil) with the expanded waters of Ontario.

As the burning mountains of Italy command the astonishment of mankind, so the cold boiling Springs of Saratoga ought, I had almost said, to demand their adoration. How vastly different, yet how equally curious are these two subjects! while the magnitude of Vesuvius defies any comparison with the diminutive size of the Rock of Saratoga, still the compact petrified hardness of the latter, equally abhors comparison with the cineritious crumbling texture of the former: while that *occasionally* bursts forth in *furious* flames and torrents of fiery lava, to the *terror* and oftentimes to

the *destruction* of the surrounding neighbourhood, and requires a blind confidence, in a supposed protecting saint, to preserve the inhabitants from *incessant* apprehension, this *constantly* boils up a refreshing fountain, attended as it were by Hygea herself, dispensing *health* and *happiness* to all around.

THE
MINERAL WATERS
OF
SARATOGA, &c.

*Topographical Description of the Country,
and situation of the several
Springs.*

THESE Springs are situated on the side of a valley, which lies about twelve miles west of the confluence of Fish creek with the Hudson or North river, in the county of Saratoga and state of New-York, and about two hundred miles above that city. This valley, at least the part of it where the Springs rise, runs a northerly and southerly course, and appears to have been formed by a

branch of the Kayadaroforas river, which flows through the middle of it, and empties itself into Owl pond, whence it effects a junction with the main stream, at a small distance from where that terminates in the Saratoga Lake.

The high ground that forms the westerly bank of the valley, whence the waters of these springs, which are situated at its foot, appears to have been derived, is composed almost entirely of calcarious rocks, whose surface however, is mostly overspread with a sand and clayey soil, and covered with tall pines and oaks. There are several deep subterraneous caverns observed in it, which open but a small distance from where the declivity commen-

ces. The bank on the easterly side appears almost entirely sand, with not the least vestige of calcareous earth, and is a perfect pine plain.

The cause of this sudden change of soil, and also of the rivers making its way, at this particular juncture, I leave to the speculation of the naturalist to determine : a mere knowledge of their existence and situation being all that is necessary, either as to their affording us an assistant means for ascertaining the nature of the Mineral Waters in their neighbourhood, or as enabling us to account for the presence of ingredients found in them. About four miles west of these springs, I am informed there is a strong scented sulphureous spring.

The springs are eight or ten in number, and all are within the space of about half a mile. THE ROCK SPRING has particularly attracted the attention of the curious, and is mostly drank of by valetudinarians. It rises about midway between the others, and is entirely furrounded by a rock of a conical shape, which is about five feet high, and nine feet in diameter at the base ; it has a circular hole in its apex, of near ten inches across, which is the opening of its inner cavity where the water, enlivened by continued streams of air-bubbles passing through it, rises to within about two feet of its top. This cavity, like the outside of the rock, enlarges as it descends. The surface of this rock is of an ash colour, and appears compact and

polished* ; it has a crack in one side, which is supposed to descend internally, and form some vent below the surface of the ground, by which the water makes its way out, as it has not been known to overflow for several years past.†

* The general substance of this rock is very different from that of its surface, for instead of being compact and solid, it is of an open and spongy texture.

† This circumstance would seem, at first sight, to be a matter of regret ; but when it is considered that we have thereby in the upper chamber, a well contrived reservoir for the collection and preservation of the gas that is constantly accumulating therein, it becomes questionable whether it ought not rather to be considered as a fortunate occurrence, for while the water is not thereby put out of reach, its surface is constantly protected from coming in contact with the atmospheric air, which might deprive it of a portion of its sparkling briskness: it at the same time furnishes the chemical operator with a considerable quantity of the

This fracture in the rock, is believed to have been produced by the fall of a tree across it ; and the remains of the upper part of one which lies in the marsh below, and whose body is directed immediately towards it, renders this opinion very probable, since its size and situation prove that it must have stood on the opposite side of the spring. Indeed I am informed by a man of that country, that he very well recollects when the tree stood there, and that then the water overflowed

pure unmixed air, ready collected to his hand, for making such experiments as he may wish, either to ascertain its nature or to demonstrate its qualities. The specific gravity of this air being greater than that of the atmosphere, prevents it from being readily dislodged from its apartment.

the rock. Another person informed me, that he knew it to overflow in the time of the late revolutionary war.

All these waters naturally deposit a petrifactive matter over where they flow, thereby forming to themselves a barrier against the intrusion of foreign substances. How the Rock Spring, in particular, has surrounded itself by such a regular formed conical mass, is a subject of curious investigation. For my own part, I am disposed to conjecture, that the main body of it was originally formed below the surface of the earth, by the calcareous substance which is continually separating from the water, (in consequence of the escape of the super-

bundant carbonic acid) insinuating itself among, and in some degree uniting with, the surrounding heterogeneous earthy matters: whence the reason of its spongy texture. This hardened mass then resisting the floods of rain, which washing down the bank, and gradually carrying off the looser earth from around it, it necessarily would, in time, become above the level of the adjacent ground, the natural situation of this spring rendering it of more difficult access than the others, would secure it from being trampled down by such animals as may have resorted there for drink. Since its exposure to the air, perhaps during the course of ages, the water has been permitted unmolestedly to

precipitate particles upon particles of the stony matter upon its surface, till finally it has become covered with that compact, solid substance, which adds so much to the beauty of its present appearance.

THE BATHING SPRING.

This has obtained its name from its furnishing the waters that are continually conveyed from it into the bathing-tub, which is in a log inclosure just below it, in the marsh. It is situated a small distance from the Rock Spring, and has afforded a much greater quantity of the petrifactive deposition ; so much indeed, as to have formed an irregular rock around itself, of upwards of 20

feet in diameter; but by being more easily come at, its tender layers have been continually trodden down, as they formed, before it could assume any regular shape.

The *stony matter* of these Springs, by calcination, formed *quicklime*.

A piece of it put into *sulphuric* (vitriolic) *acid*, caused a great effervescence, and formed a *selenites*, or *plaster of paris*, and also a small portion of *alum*, as was proved by the solution depositing a cloudy *sediment*, on passing *volatile alkaline gas* through it. This solution also contained the *sulphate of iron* (copperas) whence it assumed a beautiful *blue* colour, by the addition of *lime water saturated with Prussian blue*, and became *purple* by dropping into it the

tincture of galls. These experiments lead to the conclusion that the petrification must be composed of an *argillo calcareous earth* and *iron**. To this last is owing the reddish colour with which great part of it is tinged.

Having settled these preliminaries, we proceed more particularly to enquire into the

NATURE OF THE WATERS.

I. *Of their Physical Properties.*

1st. These waters, in general, appear *nearly transparent*, yet none of

* The circumstance of this petrification containing argillaceous earth, supports in some degree the conjecture respecting the original formation of the conical Rock, since this earth could not have been derived from the water itself, as that does not appear to contain any in its composition.

them perfectly so, excepting that which rises up in a barrel, which the neighbours have fixed for the purpose of collecting it, and is called the *Barrel Spring*. They are *colourless*, and emit a great quantity of air by agitation ; even by standing still, in an open vessel, it almost immediately forms bubbles around its inside, which soon rise up and are discharged. The vessel used to dip the water out of the rock, and also the bathing tub, soon gather an *ochery crust* upon their inner surfaces. Wherever these waters stagnate, around the springs, besides depositing the stony matter before mentioned, their surface also soon becomes overspread with an *iri-*

descent pellicle of a metallic splendour, reflecting variegated colours.

2d. They diffuse a subtle penetrating odour, which is most particularly experienced by breathing in the orifice of the rock.

3d. When drank, their first impression on the palate, is agreeably *acidulous*, succeeded by a nauseous *saline* taste; they afterwards give up *acescent eructations*, like fermented liquors, and which are no ways unpleasant.

4th. The *hydrometer* stands at the same height in these, as in snow-water.

5th. Notwithstanding the discharge of air from these waters makes them appear to be in a continued ebullition, yet they are *cold*.

Their temperature, however, is not the same in all the springs, but seems to diminish in proportion to their briskness. Thus the Bathing Spring and the Barrel, each of which discharges about twenty gallons in an hour, lowered Farenheit's thermometer from 72° , the heat of the atmosphere, to 52° while in the others, which are much slower, it stood at 56° and 58° , but in the Rock water it remained at 67° .

6th. By the application of a *gentle heat*, these waters discharge a great quantity of *air* in bubbles: it is upon this property that their use in raising bread depends, and for which purpose they are carried away in considerable quantities daily, even sometimes to eight or ten

miles distance ; all that is necessary being merely to make the dough, with flour and this water alone, and it is immediately ready to be put into the oven.

II. *Experiments upon the Air.*

1st. A *lighted candle* let down in the crater of the rock, was immediately *extinguished*, both blaze and wick, before it came within a foot of the surface of the water. The air obtained by agitating the water of this, as well as of the other springs, was equally incapable of supporting combustion, as was also that collected from the bubbles, that were continually discharging from the different springs.

2d. A *chicken* being immersed in this air, *expired* in three minutes.

A *kitten* confined in it for one and a half minutes, appeared very flaccid and almost *dead*; yet, on being brought out, into the atmospheric air, its fleeting life was soon recalled, through the medium of violent convulsions. Being again put into the noxious gas, in fourteen minutes it was irrecoverably *dead*.

3d. The *air* being made to pass through *lime-water*, immediately rendered it very *turbid*.

4th. A diluted *tincture* of *turnsol* was tinged *red* by having a portion of this air passed through it.

From the physical qualities mentioned, and from the above experiments, we may safely conclude, that this air is the true *carbonic acid gas*, the *spiritus mineralis* of Hoffman,

the *gas silvestre* of Van Helmont, the *aerial acid* of Bergman, the *fixed air* of Priestley, Cavendish and Black, the *cretaceous acid* of Fourcroy, and what is generally known with miners by the name of *choak damp*: it is similar to the *noxious gas* which rises up to the height of some inches in the famous *grotto del cani* in Italy. This cave having received its name from its fatality to dogs, they from carrying their heads below the surface of this stratum of air, being the animals which are generally submitted to experiments, to satisfy travellers of its deleterious effects.

It is this air which is so plentifully given out during the spirituous fermentation, and is what gives

that briskness to porter, champagne and other fermented liquors. Being united with the vegetable alkali, it forms the common potash of commerce. Hence the reason why our good housewives are enabled, any time, at half an hour's warning, to furnish us with a well raised cake, merely by mixing up the flour with a solution of potash and sour milk. Here the acid of the milk, from a greater attraction, joins itself to the alkali, while the carbonic acid taking its ærial form upon being set at liberty, and assisted by the expansive power of heat, penetrates and puffs up every particle of the dough. It is this air also which constitutes the difference between quick-lime and chalk or limestone. Its discharge is the effect of their calcination.

III. *The effects of Re-agents upon the Waters.*

1st. The Rock water had a little of the *tincture* of *turnsol* dropped into it, which immediately gave it a *reddish tinge*.

2d. The *infusion* of the *blue petals* of our common *larkspur** was not changed by it.

3d. In *lime-water*, it instantly induced a *milky turbidness*, followed by a *deposition* of a *white powder*.

4th. *Tincture* of *galls* rendered it *purple*†.

* The infusion of blue larkspur I have found to be a most accurate test for discovering the presence of the smallest quantity of alkalies and of fixed acids, but not the carbonic.

† It has been observed, that notwithstanding this water mixes with gin, without discolouration, yet it will not make grog; for immediate-

5th. *Prussiate of lime* produced no change in it.

6th. A *solution of potash* (caustic vegetable alkali) produced a *turbidness* in it.

7th. It was also made *turbid* by *carbonate of potash* (aërated vegetable alkali).

8th. *Ammonia* (caustic volatile alkali) forms a *cloudiness* in it, yielding a *white precipitate*.

9th. *Sulphuric acid* (oil of vitriol) dropped into the water, caused a great *effervescence*, and a *little turbidness*.

ly upon pouring in the spirits, it becomes blackish. This, though unaccountable to many, is no more than what every chemist would expect, when he considers that from the oak casks in which spirits are kept, it generally becomes a true tincture, of a vegetable astringent.

10th. After sulphuric acid had been dropped in the water, it then became *blue* by *Prussian lime-water*.

11th. *Nitrate of silver* dropped into the water, formed an immediate copious *white curdled precipitate*; this, as also the water itself, soon assumed a *dirty bluish* colour.

12th. *Nitrate of mercury* produced a copious *yellowish precipitate*.

13th. *Acid of sugar* occasioned a *cloudiness* which soon settled down in a *white precipitate*.

14th. *Acetite of lead* produced a copious *white*, but *not granulated, precipitate*.

Most of these experiments were frequently repeated, and with similar results.

The waters of the other springs

exhibited the same appearances, with the above re-agents, as the Rock water, excepting that of the Bathing Spring, and of the Barrel, both of which shewed a deeper purple tinge with tincture of galls. By *boiling* the water, it discharged a great quantity of *air*, and formed a *pellicle* upon its surface, and *deposited* a *white powder*. Afterwards it had not that brisk acidulous taste, as before, but was extremely nauseous : it was *not* reddened by tincture of turnsol, nor rendered purple by tincture of galls : with infusion of larkspur it became green : it still *precipitated lime-water*, though not so plentifully as before, and also *effervesced* slightly, with sulphuric acid, but was not made turbid thereby :

it changed the yellow matter of *turmeric* to an *orange red* or *brick colour*. Acid of sugar did not induce any turbidness in it; it formed a *light cloud* upon standing a little time with the *caustic vegetable alkali*, but was not altered by the aërated vegetable alkali (carbonate of potash).

From the foregoing experiments, I conclude that *these waters contain*,
1st. *An uncombined acid*, whereby they become red by tincture of turnsol, and that this cannot be a fixed acid, since it does not redden infusion of larkspur, and is evaporated by boiling; for afterwards the water does not change the tincture of turnsol, therefore it must be the carbonic acid gas, (fixed air) the same as has been heretofore proved

to be continually discharging from them, in large quantities. It is from the presence of this, that lime-water becomes so very turbid, for with lime, unless by a supersaturation, it forms a compound insoluble in water.

2d. *Iron*.—Hence it takes a purple tinge, with tincture of galls; and also, when previously joined with sulphuric acid, becomes blue, with prussiate of lime (Prussian lime water). The iron is not kept in solution by the sulphuric acid, or it would have become blue by this test before the acid was added to it, but by the carbonic acid. Hence after being boiled, this water is not discoloured by tincture of galls.

3d. A quantity of *lime* held in so-

lution by a supersaturation with carbonic acid; for notwithstanding lime, as before observed, is rendered insoluble by uniting with this acid, yet it is otherwise when supersaturated therewith; for then it is, to the contrary, much more soluble. Hence the cause of a precipitation, by the pure potash and by the ammonia. They, from their affinity to the acid, deprive the lime of its superabundance, and permit it to fall down in a white powder. The sulphuric acid, on the contrary, attracts the lime, and forms a gypseous deposition, while the carbonic acid flies off in a great effervescence. The acid of sugar, also evinces the presence of lime, by uniting and forming an insoluble compound

with it. These tests did not exhibit the same appearances with the water after ebullition. Hence the pellicle and deposition, formed during that process, I take to be calcareous earth and iron.

4th. *A muriatic acid.*—Hence with nitrated silver it forms a sudden, caseous precipitate, and also a precipitate with nitrated mercury; this last, on being sublimed, afforded corrosive sublimate.

5th. *A neutral salt.* Since it is evident from the two last mentioned experiments, that these waters contain a marine acid, and by some of the previous ones, that this does not exist in them in a separate state, it must therefore be united either with an earth or an alkali; and as

a carbonated alkali will be shewn to be present in them, it is evident that it must be joined with the latter, since alkalies have a greater attraction for acids than earths have.

6th. A *carbonated alkali*, whereby, after the water has been boiled, it rendered the infusion of larkspur green, and effervesced with vitriolic acid: hence also the cause why lime-water was still precipitated by it; the carbonic acid quit the alkali to unite with its more attracting lime, formed therewith, as above mentioned, an insoluble compound. And that the phenomena were produced, at least in part by carbonate of an alkali, and not by the carbonate of magnesia alone, is evident from its changing the yellow colour

of turmerick to that of a brick red, which could only have been effected by the presence of an alkali. The reason why the water did not change the infusion of larkspur, before it was boiled, must have been owing to the alkali's being supersaturated with the carbonic acid ; in which case, (as I proved by an experiment instituted for that purpose) it may exist in considerable quantity in water, without changing vegetable blues.

7th. *A slight impregnation of sulphur*, thereby darkening the nitrated silver. This is what might be reasonably expected, as within about four miles there is a strong scented sulphureous spring.

The last mentioned experiment,

on the waters, previous to ebullition (see p. 43) proves, by the precipitates not appearing granulated, that sulphuric acid does not exist in the waters, either in a simple or combined state.

The presence of a carbonated alkali in these waters, clearly proves that they cannot contain any earthy or metallic salts other than carbonates, since the alkali, from its superior attraction to acids, would necessarily prevent their formation. From the above effects of re-agents, it appears that the waters contain

Carbonic Acid,

Carbonate of Iron,

Lime Superfaturated with Carbonic Acid,

Muriatic Salt,

Carbonated Alkali,
Carbonated Magnesia, and a
Sulphureous Impregnation.

The proportion of each of the above ingredients, and the nature of the base of the neutral salt, and the species of the carbonated alkali yet remained unknown, I therefore proceeded by the more tedious processes of Distillation, Evaporation, and Crystallization, to ascertain these points.

IV. *Distillation.*

From the experiments of Bergman and Henry, it appears that water is capable of absorbing about equal its bulk of carbonic acid gas, at the temperature of 55° , and proportionably less as its temperature is increased. Now, as the bubbles

of this air are continually passing through the waters under examination, it is clear that they must be fully saturated with it ; and as they are of the temperature at which water will retain about equal its bulk, we of course conclude, that they contain that proportion. The following experiment tends to confirm that opinion.

By means of a Florence flask, with a syphon properly affixed to it, and the application of heat, I collected, from a given quantity of this water, upwards of its bulk of aërial fluid, the greater part of which I take to be the above mentioned acid ; the rest perhaps, partly azote (atmospheric mephitis), and partly oxygen gas (vital air).

That the water contains this last, is proved by its precipitating an *ochery substance*, after having had some *sulphate of iron* (green vitriol) dissolved in it, in a well corked vial.

V. *Evaporation.*

By evaporating ten pounds of the water of the Rock, in glass vessels, by the heat of a water bath, I obtained an ash-coloured residue, which when dried weighed 403 grains. This residuum was put into four times its weight of *spirits of wine*, which after standing a considerable time, being frequently agitated, was filtered and dried, and was found to have lost about 17 grains, which proved to be *common salt*; for by evaporating the spirits, I obtained it in regular *cubic* crystals.

This circumstance of spirits of wine dissolving a portion of marine salt, I take to be owing to its not being so highly rectified as it ought to have been, for if perfectly pure it would only have taken up muriate of lime, muriate of magnesia, nitrate of lime, nitrate of magnesia, and muriate of terra ponderosa; but when somewhat diluted, it will, besides these salts, also take up others. However, as by evaporation I obtained nothing but cubic crystals, I again conclude, positively, what in fact was before proved by re-agents, that there are none of the above mentioned earthy salts in these waters.

I now immersed the residuum in 8 oz. of cold water, which after re-

maining several hours, being frequently agitated, was filtered. The insoluble part, when dried and weighed, was found to have lost 182 grains. This watery solution, by turning the infusion of larkspur green, appears to contain an alkali uncombined with any of the fixed acids. This solution not changing the colour of the infusion of larkspur to a red, renders it evident that the muriatic acid before shewn to be contained in these waters, cannot be in an uncombined state: and indeed the presence of a carbonated alkali in them, proves that it must be in combination with a salt of that kind; for having a greater attraction for them than the carbonic acid has, it would necessarily pre-

vent the existence of a carbonate, unless it was itself previously saturated. We may therefore now again conclude that the waters contain a muriatic neutral salt.

This solution of a muriatic neutral salt and an alkali, I submitted to the heat of the sun; whereby, after great part of the water was evaporated, some cubic crystals appeared to form upon its surface, but which were soon disturbed by irregular saline concretions.

Having ascertained the presence of a muriatic neutral salt, and an alkali, but not knowing decidedly, either the species of the alkali, or the base of the neutral salt, I made a saturated solution of this mixed salt, and added thereto acid of tar-

tar, and no precipitation taking place, I concluded that the alkali could not be of the vegetable kind, or it would have fallen down in the form of cream of tartar : therefore the aërated alkali must be the mineral alkali, (carbonated soda) and the base of the neutral must be the same, which with its acid, forms our common *sea salt* (muriate of soda).

To find the proportion of the marine salt and the soda, I dissolved the mixed salt in water, and added distilled vinegar thereto, until I brought it to the exact point of saturation. I then saturated an equal quantity of distilled vinegar, with carbonate of soda, for which purpose it required 26 grains ; whence it appears that ten pounds of this mi-

neral water contain 26 grains of carbonate of soda ; the remainder, 156 grains, must be muriate of soda, which added to the 17 grains dissolved in the spirits of wine, makes 173 grains, the amount contained in that quantity of the water.

The remaining 204 grains I exposed to the sun, for several weeks, moistening it frequently with rain water. This was done in order to rust the iron, so as to make it soluble in distilled vinegar, in which this residue was afterwards digested and filtered. The filtered liquor was then evaporated, and what was left was re-dissolved in sulphuric acid, with which it formed sulphate of lime (gypsum) but no bitter salt. Hence, as there were but about 12

or 14 grains remaining on the filter, it appears that ten pounds of this water contain 190 grains of lime, but very little if any magnesia.

The substance remaining on the filter, by being dissolved in vitriolic acid, afforded 8 1-2 grains of iron, precipitated in form of Prussian blue, by the Prussian lime-water.

It appears from a review of these experiments, that ten pounds of this water must contain,

Carbonic Acid (fixed air) which when extricated in form of gas, measures about 200 cubic inches,

Carbonate of Soda 26 grs.

Muriate of Soda (sea salt) 173

Super-Carbonated Lime, 190

Carbonate of Iron, 8.5.

Besides the Mineral Waters that have been already noticed, there are others in the county of Saratoga. About three miles below the junction of Fish creek with the North river, and about two miles west of the latter, in a hollow immediately back of the dwelling house of *William Barker*, are several Mineral Springs, the waters of which, both by their sensible qualities, and by the operation of re-agents, appear to be very similar to those heretofore mentioned. They do not, however, deposit the stony matter, nor do they in other respects, appear to be so strongly impregnated with Mineral substances.

They are situated in a clayey soil, with no appearance of lime-stone in

their neighbourhood. The land is covered with beach and oak trees.

The *air* which bubbles up in these springs, appears to be the same *acid* as is discharged from the other springs: it equally *extinguishes flame* and renders *lime-water turbid*, &c. Aquatic animals cannot support life when submersed in this water. A *fish* in two and a half minutes *died* in it.

Iron appears to exist in these waters, by their becoming *tinged*, though slightly, with *tincture of galls*; and it must be held in solution by means of the carbonic acid, as they were not changed by the tincture after they had been boiled.

Lime rendered soluble by a superabundance of carbonic acid, was

detected in these, by the same means as were used with the other waters. They probably contain a carbonated *alkali*, for after being boiled, they still *effervesced* with *sulphuric acid*. *Muriatic acid* is proved to exist in them, by the *nitrated silver* and *nitrated mercury*, and it must be in combination; thereby forming a *neutral salt*, whose base, though not fully ascertained, is presumed from its taste, and the great similarity there is between these and the other waters, to be of the mineral kind; therefore the neutral I believe to be *sea salt*.

Besides these ascescent springs, there is another in the same hollow, about a stone's throw distance from them, which is entirely of a differ-

ent nature, and from its smelling like the washings of a gun-barrel, has obtained the name of *Gunpowder Spring*. The water is transparent; its *temperature* 58° ; it *smells* and *tastes* like *sulphur*, or rather *hepar sulphuris*. By boiling, it loses both its disagreeable smell and taste.

The *air* discharged from it by boiling, being made to pass through *lime-water*, produced *no turbidness*: hence it contains *no free carbonic acid*.

This water is *not discoloured* either by tincture of galls or *Prussian lime-water*. With *nitrated mercury* it forms a *precipitate*.

With *nitrated silver* it also forms a *precipitate*; which, as well as the

water, directly assumes a *dark purplish brown colour*. This precipitate is suspected to arise from a marine acid, and the dark colour from a hepatic or *sulphureous gas*.

Sulphuric acid produces an *effervescence*. This must be owing to the presence of a *carbonated alkali*. It also rendered *lime-water turbid*: this might be from the same cause. Hence the above-mentioned *muria-tic acid* must have been in combination in form of a *neutral salt*.

BALLSTON.

PLACES, like persons, after having attained a certain degree of celebrity, frequently undergo a change in their names. Thus the modest *fontaine de belle eau* has become the admired *Fontainbleau*, and the once obscure town of Brighthelmestone has become the brilliant *Brighton*. So also Ballstown, which afterwards to distinguish it from a place of the

same name in the District of Maine, was called Balltown, has finally, in seeming subserviency to the *ton* of the times, assumed the more fashionable title of *Ballston*.

THE BALLSTON SPRINGS arise about seven miles to the southward of the Rock Spring at Saratoga, and like that, they are situated in a valley, through which also runs a branch of the Kayadaroforas. The soil nearly adjacent to the Spring, is poor and sandy. Upon digging down into it, Dr. Vandervoort says, it becomes intermixed with clay and with some ferruginous particles appearing like the rust of iron; and in some places he observes, large quantities of bog ore are found: one bed in particular, he notices, a

little to the westward, and almost adjoining one of the Springs.

The produce of the soil in the immediate vicinity of the Springs, is chiefly pines, scrub oaks, and some chestnut, together with ferns and mulleins.

The *temperature of the water* of these Springs in the summer, varies from 50° to 58°, about the same as the medium temperature of the waters of Saratoga. These waters have *air* bubbles constantly passing up through them; they sparkle in the glass, and when drank give an *acidulous*, followed by a *saline taste*, though not so nauseous as those of Saratoga. They affect the nose and palate with a pungent penetrating sharpness, like mead or lively bot-

tled cyder, and oftentimes a draught of them is succeeded by similar eruptions. From experiments made upon it, this air appears equally, with that from the waters of the other springs, to be *incapable* of supporting *combustion* or *animal life*.

From the effects of re-agents and from evaporating this water, and separating the different parts of the residuum, it appears to be very similar to the water of the Rock Spring. Dr. Vandervoort found it to contain,

Muriate of Soda,
Carbonate of Lime,
Carbonate of Iron, and
Carbonic Acid.

This account of Dr. Vandervoort's experiments was published in 1795,

about two years after the publication of the first edition of my Dissertation on the Waters of Saratoga.

In the year 1808 there appeared in several of our newspapers, an account of the analysis of a bottle of the Ballston water, said to have been made in France. This account was afterwards treasured up in the form of an article in the Medical Repository of New-York, and again republished in the Monthly Anthology of Boston, stating it, at the same time, as a public benefit, &c. From this account having thus obtained a place in such respectable publications, and differing as it does, in several respects, from the analysis before mentioned, justice to Dr. Vandervoort and duty to the

community require, that we give it some attention, and that the waters should be more particularly examined ; not merely to settle the difference between the two experimenters, but for the more important purpose of ascertaining what, in truth, are their real contents ; especially as they now have got into such general use, and are so frequently prescribed by physicians. Silence, upon this occasion, would seem to give a sanction to what it is presumed the following investigation will prove to be highly erroneous in that account, which is stated to be an *accurate* analysis, published under the imposing authority of a person, who (though his name is not mentioned) is said to be one

of the most celebrated chemists of France. The *account* says, that a bottle of the water, after having been transported to France, contained *three times its bulk of carbonic acid gas*. Whereas, by a well directed experiment, Dr. Vandervoort could obtain at most, not above a third part of that quantity from it, and that when fresh from the fountain. This experiment, related at full length, ought of itself to satisfy us as to his conclusions. But when in addition thereto, we consider that neither *Bergman* nor *Henry* could cause water, at the temperature of the Ballston Waters, to absorb more than about that proportion, we can no longer doubt that the French account is greatly exaggerated, and in-

stead of the waters containing treble their quantity, that they have not more than *equal their bulk* of *carbonic acid gas* fixed in their composition.

Further, the two accounts differ in respect to the state of the calcareous matter held in solution; for while the French chemist asserts that they contain a quantity of the muriate of lime, Dr. Vandervoort makes no mention of that, as a part of their composition. To determine this point, having procured some of the Ballston water, I evaporated it to one fourth part of its original quantity, decanted and filtered the liquid, and dropped into it a solution of *oxalic acid*, which produced a slight *effervescence*, but *no*

cloudiness or precipitation took place ; whence it is evident that *no muriate of lime* existed in it.

To ascertain still further what other matters were contained in this water, the evaporated portion of it was submitted to the following experiments, viz.

1. A paper stained *blue* with the petals of the common iris, was changed to a green by being immersed in it.

2. Strips of the same paper, previously reddened by a very diluted nitric acid, were by it, first gradually restored to their original blue, and then also became *green*.

3. *Lime-water* rendered it *milky*, and deposited a copious *precipitate*.

4. *Nitric acid* dropped into it, produced a *discharge of air bubbles*.

5. A *solution of potash* produced a slight turbidness in it, which by standing, formed a permanent *thick cloud* near its surface. This afterwards was dissolved with effervescence, by the addition of a few drops of the *fulphuric acid*, and the liquid resumed its former transparency.

6. The *muriate of lime* rendered it *turbid*, and let fall a dense and apparently heavy *precipitate*.

7. *Carbonate of soda* exhibited *no evident effect*, upon being mixed with it.

8. The *carbonate of ammonia* added to it, did *not* effect its transparency.

9. *This mixture of it with carbonate of ammonia*, immediately lost its transparency, became *turbid* and let fall a *precipitate* by the addition of the *phosphate of soda*.

10. The *yellow colouring matter of turmerick* was changed to a *brick red* by being mixed with it.

All these phenomena, as well as the discharge of air by the addition of the oxalic acid, in the first aforesaid experiment, are easily explainable, upon the presumption of the presence of the *carbonate of magnesia* and the *carbonate of soda*; and as they seem inexplicable upon any other principle, in my opinion they fully establish the fact of these substances being a part of the composition of these waters. If then these

waters contain the carbonate of soda, it is impossible that the muriate of magnesia (stated by the aforementioned account to be a part of their composition) should exist in them; for the superior attraction of the alkali for the muriatic acid, would utterly prevent the formation of a magnesian muriate.

Finally, I think we may safely conclude that the Mineral Waters of Ballston hold in solution,

Carbonic Acid,

Muriate of Soda,

Carbonate of Lime,

Carbonate of Soda,

Carbonate of Iron, and

Carbonate of Magnesia.

Nor will any experiments yet published, warrant us in concluding that they contain any thing else.

OF THE
USE AND MEDICINAL VIRTUES
OF THE
WATERS
OF
SARATOGA AND BALLSTON.

EVERY local consideration, beside the highly medicinal virtues of the waters themselves, tends to render these Springs equal, if not superior, as a place of general resort, to any of the most distinguished watering places in Europe. The face of the surrounding country, diversified with Lakes and intersected with the branches of the

Kayadaroforas, the vicinity of the majestic Hudson, with its fine hanging bridge, on the east; the rich Mohawk, and the roaring cataract of the Cohoos, on the south; together with the romantic mountain scenery on the north and west, all conspire to make this one of the most interesting spots that the imagination could conceive. The sportsman here, need never languish for want of employment: should fishing be his favourite amusement, he has the lakes and rivers at his command: if he delights in his gun, here are not wanting objects whereupon to try his skill. To those who are fond of riding and of enjoying the sublime and varied scenery of nature, no

country is better calculated than this to gratify their taste. When to all this, we add the extraordinary accommodations and entertainment furnished at Ballston, equalling the most unbounded wish, we cannot be surprised that these, like most other celebrated Medicated Springs, from having at first been the refuge of suffering humanity, the comfortable asylum of the afflicted invalid, should become the seat and empire of luxury and dissipation, the rallying point of parties of pleasure. Where one person *now* applies there to repair a disordered constitution, twenty go, in the gaiety of health, to sport a sound one, against the enervating influence of revelry and riot. It is hoped, how-

ever, that like the fashionable resort at Spa, the distant situation of the different Springs from each other, will assist in preventing those votaries of pleasure from sinking into that state of indolence and inactivity, so apt to prevail at such places of public rendezvous.

The favourable circumstance of the relative situation of the several objects of attention in this neighbourhood, taken all together, is certainly matter for congratulation to that class of visitors whose chief view is to pass their time agreeably ; for besides the sources of amusement just mentioned, other considerations will, in addition, impose a kind of necessity on many of keeping themselves actively engaged. For while

the superior accommodation fixes upon Ballston as the place of dwelling, the Springs of Saratoga will command frequent visits. For who, making the least pretensions to the character of a *virtuoso*, would stoop to drink of the waters of Ballston, when a few miles ride would treat him freely with plenteous draughts from the fine stone *vase*, that superb piece of nature's unassisted workmanship. The more powerfully purgative quality of the water of the *Congress Spring*, will secure it a repeated call from those who require its evacuative operations. And as to the *Lakes*, which are interspersed in different directions a few miles distant from the Springs, no professional man can entertain a

doubt that the more detergent properties of their *soft* waters, will richly reward those for their trouble, who may visit them for the purpose of Bathing.

Duly to attend to all the above enumerated objects, and to improve them to the best advantage, will require repeated and varied excursions, all which will occupy time, and they will occupy it to good purpose; for hereby, while indulging in a pleasurable exercise, we are gaining, as far as respects our constitutions, all the advantages of labour, and that beguiled of its toils.

“ From labour health, from health contentment springs ;

Contentment opes the source of every joy.”

This mode of passing the time, it is true, may chill the mace and paralyze the balls of the billiard board, but it will warm the heart, and promote the healthy movement of its blood : it may diminish the demand for cards, but it will enhance the value of life.

“ . . . *ut sit mens sana in corpore sano.*”

“ A healthy body and a mind at ease.”

Let us then be upon the alert, and by well directed exertions repel the approaches of disease, and keep clear from the favours of the Faculty : it is assuredly

“ Better to hunt the fields for health unbought
Than fee the Doctor for a nauseous draught.”

Having dispensed these wholesome admonitions to the well, we

now shall attend to the more serious calls of the sick, by noticing

The operation of these waters, and the diseases wherein they may be usefully employed.

These waters may generally be taken in very large quantities without producing any uneasiness or sense of weight in the stomach; but in some instances they cause a sense of coldness, and sometimes, though very rarely, prove emetic. Some persons will drink several quarts within half an hour, without any inconvenience, otherwise than affecting the bowels two or three times, and operating very copiously by the kidneys. They at the same

time produce a gentle diaphoresis. They however act more particularly upon the two last excretions, when taken in smaller doses, and often repeated, as from half a pint to a pint, every third or fourth hour.

Their operation upon the bowels may pretty certainly be calculated upon, if taken before breakfast: if not taken till afterwards, they more generally affect the other excretions. Hence by a little attention to the time, and to the quantity taken, we are enabled to determine their action to such parts, as the nature of the case for which they are directed, may require.

These waters generally exhilarate the spirits, and sometimes produce

a very troublesome vertigo. In some persons they are said to induce a degree of inebriety, similar to wine. They not unfrequently cause drowfiness. They increase the appetite, and prove a pleasant stimulus to the stomach.

Such are the effects of these waters upon persons in health; but as the medicinal virtues of mineral waters must depend upon the different substances that they hold in solution, so their application in the cure of diseases must be directed by a knowledge of the qualities of the predominating articles in their composition. Inattention to these considerations, still tends to support what former ignorance, as to their contents, originally establish-

ed in respect to the use of them. They had proved efficacious in the cure of some diseases, but upon what principle was unknown.—Hence, like most other remedies which gain a degree of reputation before their real qualities are known, they were looked upon as a kind of *panacea*, a cure for all diseases : so that to be *unwell* was a sufficient reason for applying to them for relief ; they were indiscriminately taken in diseases of directly opposite natures : hence intermittents and hectic fevers, pleurisy, dropies, manias, dyspepsias, &c. all equally were found hovering there for help. When at the Springs, I saw a person who had come upwards of three hundred miles to

drink the waters for the cure of a fistula lachrymalis, and no doubt many other poor sufferers have toiled through difficulties to get there, who finally, instead of meeting with a reward for their pains, have, to their cost, experienced not only no alleviation, but in some instances an aggravation of their complaints, for *an universal remedy is a perfect solecism*. It is an unquestioned law in medicine, that *that which possesses active curative powers in one set of diseases is equally detrimental in others*.

The *carbonic acid*, *salt* and *iron* are the principles upon which we should chiefly ground our calculations in the use of these waters. The *alkali* may, in some cases, have its effects, and in others we may ex-

pect some advantage from the carbonate of lime. In regard to the comparative virtues of the waters of Saratoga and Ballston, little need now be offered: the former, particularly the Congress Spring, is somewhat the most purgative, they however, appear to be composed of very similar materials: it may generally, perhaps with propriety, of *them* be said, that “that which is best administered is best.”

Of the diseases for which these waters are prescribed, there is probably none which will more certainly support their reputation and keep up a round of company, than *Dyspepsia*. As long as the pamperings of luxury and the love of ease shall prevail over simplicity in diet

and an active life, so long will the Springs be resorted to by a train of invalids. The change of air and exercise necessarily imposed thereby upon those who reside in large cities, the fruitful nurseries of such complaints, together with the material contents of the waters themselves, all seem calculated for relieving such affections. The carbonic acid furnishes the cordial exhilarating stimulus, the salt promotes digestion, while the iron restores the lost tone of the enervated stomach: at the same time the soda corrects the acidity so often predominating, and the whole composition, when judiciously managed, obviates that costiveness, so frequently an aggravating attendant upon them. Hence

we have every reason for counting upon their salutary operation, and experience fully justifies our calculations.

Calculous complaints are among those which apply there in the greatest proportion for relief, nor do they apply without reason; the composition of the waters being such as would lead us, *a priori*, to look to them as a remedy. From the experiments of Saunders, Percival and Falconer, we learn, that calculi, immersed in water impregnated with the carbonic acid, were diminished. Priestley, Percival and others have proved that fixed air, as well as alkalies would, when taken into the stomach, pass through the circulation and appear unde-

composed in the urine. Hoffman and other German writers speak highly of the efficacy of the Spa and other acidulous waters, both in preventing and dissolving the stone. Springsfeld observed that human calculi were diminished by being immersed in the urine of a person who drank of the acidulous waters, while that of a healthy person, not drinking of them, added to their bulk.

Egan and Murray have again ascertained, that both lime-water and the carbonated alkalies destroyed and broke down calculous concretions out of the body. Ancient authority establishes the practical utility of the former, while it appears by the cases related by Bed-

does and other modern practitioners, that the latter have been successfully employed in relieving both gravel and stone.

Here then we have in these waters all the remedies that have proved the most efficacious in such affections, viz. A superabundant carbonic acid, the carbonate of soda and lime. Indeed the benefit experienced by those who have drank of them, fully answers our expectations. A number of cases have come within my own particular knowledge, and Dr. Powell, whose long residence at the Springs has given him a full opportunity of ascertaining the fact, assures me that *they are a valuable remedy in gravel, and that he has rarely seen a case of it, where relief was not obtained.*

The powerfully antiseptic quality of the carbonic acid, has lately been successfully employed by means of the yeast poultice, in the treatment of ill-conditioned *Phagedenic and gangrenous ulcers*: its efficacy in correcting their putrid nature, has been such in the New-York Hospital, that the surgical wards which formerly were distinguished by their peculiar offensive smell, have, since the more general use of this remedy, become as sweet and free from noisome scent as any of the other apartments. Beside correcting the putrid nature of the discharge from the ulcers, it also changes their disposition, favours the growth of healthy granulations, and promotes their healing.

Now from the established salutary operation of this predominating principle in these waters, we can have no doubt but that they may be a useful remedy in such complaints ; and indeed the general report corroborates that opinion. Dr. Powell says, that *in phagedenic ulcers the most happy effects may be expected from the use of them.*

In *Chronic rheumatisms* these waters have been said to be a remedy, particularly when their internal use has been accompanied by a judicious application of them as a bath. In *General relaxations of the system*, either from intemperance, or from a long residence in a hot climate, from the effects of syphilis, or from long and repeated courses of mer-

cury, their conjoined stimulant and tonic powers promise to be of service.

In *Chlorosis* and other affections arising from *debility in the uterine system*, such mineral waters have been successfully employed; nor need we doubt of their usefulness, particularly if their operation is supported by due attention to exercise and a properly regulated diet. From their conjoined purgative, antiseptic and tonic qualities, they appear to be properly formed for the cure of *Dysentery*. A person at the Springs, who was taking them for this complaint while I was there, informed me, they had formerly cured him of it.

Cutaneous eruptions frequently

prove obstinate of cure ; they are consequently found in great plenty at these Springs ; and I am happy to add, that they have generally disappeared by the use of the waters : for this purpose they must be used externally as well as internally. We need not be surprised that these waters are so very useful in such complaints ; since they are gently diaphoretic, and their application in bathing, besides keeping the skin moist, also furnishes an alterative stimulus by means of the sea salt, carbonic acid and the sulphureous impregnation with which they abound, well calculated for the purpose*. The car-

* I am told that during the Revolutionary

bonic acid itself, when applied in another form, I have repeatedly found an effectual remedy in some obstinate herpetic affections, as the *psoriasis diffusa* and in the *palmata*, or what is commonly called the *salt rheum*; a simple solution of salt has also sometimes effected a cure.

Their use in *hypochondriasis* and other *nervous affections*, arising from the indolence and luxury of a city life, and consequently a considerable distance from the Springs, perhaps depends in a great degree, upon the amusing scenes, more simple food and constant exercise, which

War, while the troops lay at Saratoga, many of them were affected with the itch, and were sent off in companies to these Springs, by which they were all cured.

are unavoidably connected with a long journey : and if any advantage is gained *in consumptions* from their use, I rather suppose it owing to the same circumstances ; since fixed air has, by those who have made experiments thereon, generally been found injurious in such affections. In fact, the common report condemns these waters as prejudicial in phthifical complaints, and individual observations support the popular opinion.

These waters have also been in repute for the cure of *Dropſy*, and from their possessing such a conjoined stimulating and evacuative quality as already mentioned, it appears no way improbable but that, particularly in the early stages of

the disorder, they may promote the absorption of the fluid in the cavities of the human body, and carry it entirely out of the system.

There are likewise very satisfactory accounts of *Paralytic affections* having been cured, or at least considerably relieved, by the inward and outward use of the Mineral Waters.

It has also been related, upon undoubted testimony, that *fevers and agues*, or *Intermittents*, have frequently been cured by them. It is however said, to attain that effect, that they must, beside being drank, also be used as a cold bath just before the expected paroxysm.

Among the diseases in which the waters may be usefully employed,

perhaps there is none of more importance than *Scrofula*. It is remarkable of this disease, that most of the remedies which have gained any celebrity in its cure, have been composed in part of the muriatic acid. Salt water and sea bathing have been recommended from the earliest times, and still support a deserving reputation ; of later date, the muriate of barytes and the muriate of lime have had their advocates ; and perhaps no remedy, as an external application, has been found more useful than the muriate of mercury ; and as an internal remedy, I may safely say that I have not witnessed any other preparation of mercury of more or equal efficacy.

Besides these remedies, general stimulants and tonics, as barks and chalybeates have very properly been prescribed. Whether the carbonic acid of itself, has ever been administered, I am not able to say. Marchard however (*Dissert. de Pyrmont*) says that “*the mineral waters of Pyrmont, which much abound with it, and whence their chief virtue is probably derived, are employed in scrofula with much advantage.*” In the first edition of this work, not then having known these waters to have been used for that purpose, I ventured to suggest a trial of them in this complaint, considering that from their containing the muriate of soda (sea salt) and from their general stimulating and tonic opera-

tion upon the system at large; from their promoting the different excretions, and from their acting particularly upon the glandular system, they were calculated to be a remedy. I now have the pleasure to add, from the friendly communication of Dr. Powell, that "*in scrofula their usefulness is perhaps more uniform and extensive than in any other disease whatever; and so numerous are the instances he has witnessed of their happy effect therein, that he is inclined to believe a well directed course of drinking and bathing, in those who are young, will totally eradicate its taint from the system.*"

Of the use of these waters in the removal of *Worms*, little, from experience, can be said. Sulphureous

waters have long supported a reputation as anthelmintics, particularly in cases of ascarides ; but I do not know that the acidulous waters, such as those under consideration, have ever had a trial as a vermifuge. Were we, however, to reason from the known deleterious effects of the carbonic acid upon animal life, when applied to as to affect the organs of respiration, we should naturally conclude them to be a most powerful remedy for that purpose.

From the experiment related in page 62, it appears that fish can live but a very little time in these waters. To determine their effects more particularly upon the life of worms, the common earth worms

were subjected to the following experiments: some were suspended in carbonic acid gas, which produced immediate agitation and contortion of their bodies; this soon subsided, and in the course of from two to three minutes they became perfectly relaxed and motionless. Others were immersed in water, impregnated with the carbonic acid, they instantly moved about very briskly, but in two minutes became entirely motionless and apparently dead. These experiments were frequently repeated, and with similar results. Other worms were immersed in an Artificial Saratoga Mineral Water, with like effects.

Now as these worms are so similar to those that most generally exist

in the human stomach, it is no more than fair to conclude, that they also would be equally affected by the same means.

Hence then, as the whole alimentary canal may be safely inundated with these waters, is it not highly probable that they will prove a complete remedy in such affections? It must be observed, however, that in these experiments, the worms when subjected for so short a time only, to the operation of this deleterious acid, recovered in a few minutes after being restored to the atmospheric air: but a restoration to pure air could not be effected in the bowels; particularly when under the free use of these waters; for then they must be constantly expo-

fed to the carbonic acid, until they would be dislodged and carried out of the body. With this view then the waters should be taken in large draughts and upon an empty stomach, to secure their purgative operation.

Notwithstanding worms will revive after having been exposed for only a few minutes to the operation of the carbonic acid, either in its gaseous state or when united with water, still it will, upon a longer exposure, effectually kill them. By suspending some of them in the air, and by immersing others in the water impregnated with it, they died irrecoverably in less than two hours.

Should these waters not act suf-

ficiently upon the bowels, they may be accompanied with some aloetic or other suitable purgative medicine. I have known an instance where the Mineral Water of Bedford, in Pennsylvania, dislodged and brought away a considerable portion of a tinea or tape worm: its expulsion was finally completed by taking the male fern and purgatives.

Would not injections of simple carbonated acidulous water, conjoined with a little laudanum to secure their retention for a time in the bowels, route the pestering little *ascarides* or *thread worms* from the rectum, where they so often obstinately resist almost every means usually employed to remove them?

I have frequently prescribed decoctions of the spigelia, (carolina pink) in that manner, in such instances with success. The acidulous waters are certainly much more immediately destructive to the living power of worms.

All these observations apply particularly to the acidulous Springs. The *sulphur water*, I imagine, may be more usefully applied in *cutaneous eruptions*, particularly the itch; however I do not know of any trials having yet been made with it in any complaint.

A conjecture upon the manner of the natural formation of these Waters.

The manner by which these wa-

ters become charged with their iron, lime, salt, and alkali, hardly needs an explanation. As all these substances exist ready formed in the bowels of the earth, and water after being loaded with the carbonic acid, cannot pass over them without taking up a part; but the manner in which it gains this aërial impregnation, as the carbonic acid does not naturally exist in an uncombined state in the earth, is not so easily accounted for. The carbonic acid is extricated from its combinations, in the large way, by three different processes, viz. by fermentation, by the action of a stronger acid, and by heat: the first method cannot operate in this instance, the second may have its effects: let us

try how far it will explain the subject in question.

Suppose this water first containing a marine acid, should have passed over a quantity of carbonate of soda; here the acid contained in ten pounds of it, would unite with 73 grs. of pure alkali, which contained and accordingly would discharge 58 grs. equal 116 square inches of this acid. Now the water is supposed to contain at least as much as twice that quantity; hence we see the most favourable statement of this mode, will not account even for the quantity of air actually existing as a component part of the water, much less for the great super-abundance which continually bubbles up through it, and is

discharged. We can hardly suppose the sulphuric acid to act on calcarious earth, and discharge this air, whereby the water might become impregnated before it was charged with sea salt and alkali; or else we should have detected some glauber salt, (sulphate of soda) in the waters, as they would at the time they received their air, also unavoidably become saturated with gypsum, which upon coming in contact with the alkali, would have been decomposed thereby, and formed this salt.

We therefore conclude, that this air is produced by subterranean heat acting on calcarious earth or lime-stone, thereby setting it at liberty in this great profusion: in-

deed the deep caverns opening on the lime-stone bank before mentioned, gives some plausibility to this opinion, for it clearly evinces that some considerable operations must be going forward in the earth below. The coldness of the waters may be objected against this conjecture ; but this may be obviated by considering, that even if they do not come any great distance after their aërial impregnation, yet they may have afterwards met with their salts, which, as is the case with all substances going from the solid to the fluid state, would absorb a considerable quantity of heat, during their dissolution, and thereby produce the coldness in question.—Should any one suppose that this

cause is not adequate to the production of the coldness of these waters, they are at liberty to consider them as having been aërated at a greater distance from the Springs than is suggested. The above observations, however, will not permit them to suspect but that the air they contain must most probably have been evolved from its combination by subterranean fire. The temperature of the Waters of NEW LEBANON*, which is within about 50 miles, proves the existence of

* From my own experiments and observations, and from those of my friends Professors Mitchill, Waterhouse and Post, all of whom have visited and made experiments upon the Water of this Pool, it appears to be a pure *Thermal Water*, very similar to those of Matlock and Buxton, in England; only that its temperature, which is 72° by Farenheit's scale,

subterranean heat about this country.

By the waters running over a bed of sulphur, their alkali may form a

is about 4 degrees higher than that at Matlock, but not quite as warm as the Buxton Waters.

The *Water* of this Pool is *transparent*. It has a constant ebullition of *air bubbles* passing through it.

This *air* appears to be the common *azotic gas*. It will neither burn itself nor support the combustion of inflammable substances. It does not render lime-water turbid, by being made to pass through it: nor does it communicate any effect to water, unfavourable to the life of animals immersed in it: frogs are found voluntarily swimming in the pool.

The water, when drank, produces no other effect than that of common spring or river water. It contains *no iron* or *lime* nor any other *metallic* or *earthy* matter: hence its transparency is *not affected* either by *Prussian alkali*, *tincture of galls*, *carbonated alkali*, or the *acid of sugar*. It does *not effervesce* with the *sulphuric acid*, nor does it change the colour of gold, silver, copper or lead. It neither curdles milk nor soap: it lathers and washes well.

hepar with this mineral, the gas discharged from which, gives them their sulphureous impregnation.

This water, however, *precipitates* the solution of *corrosive sublimate* (the muriate of mercury) of a *yellow* colour : it forms also a *white precipitate* with the *acetite of lead* : hence it probably contains a small proportion of some *alkaline* matter, but in such a very small quantity as not to unfit it for culinary purposes.

Let it not be inferred from these observations, that this water can be of no use in a medical point of view. No one can doubt but that free ablutions with pure warmwater, both internally and in bathing, may produce salutary effects ; particularly in cutaneous eruptions, and in cases where the system has been loaded with peccant humours, and also where irregular action in an irritable habit, has been aggravated by draughts of a more stimulating nature.

A method of making an Artificial Mineral Water, resembling in every respect that of Saratoga.

One great advantage resulting from the analysis of Mineral Waters is, the being enabled thereby to make Artificial Waters similar to them, whence all their virtues may be obtained at pleasure, and at any place, without the inconvenience or expence of attending at the Springs. There are some mineral waters, that from the fixed nature of their ingredients, may be kept for a considerable time and transported from place to place, without suffering much, if any, alteration in their nature : as for instance, those of Epfom, Richmond, Swansey, and the

like ; while others, as those of Pyrmont, Seltzer, Saratoga, &c. notwithstanding our greatest care, can be kept but a short time, and consequently cannot be conveyed to any great distance, without losing in a considerable degree their medicinal qualities : for besides the cretaceous acid, which from its volatile nature flies off, the iron that was kept in solution thereby, is also deposited ; whence they must lose the most active and essential parts of their composition. Therefore if any one would have these waters at a distance from the springs, it is art alone that can supply him. The manner in which I prepared a water resembling the Saratoga waters, was as follows :—

To a gallon of simple water in Nooth's apparatus, I added some pieces of marble, (carbonate of lime) 138.4 grs. common salt, and 20.8 of carbonated soda; that quantity being just the proportion obtained from the Mineral Water. I also suspended in it some rust of iron, tied up in a linen rag. I then caused the air that was discharged from powdered lime-stone, by a diluted vitriolic acid, to pass through the water above mentioned, till it appeared to be fully saturated. To this water was added some coarsely powdered sulphur, which after standing awhile was decanted off.

This liquor was now acknowledged by several persons who had

drank of the Saratoga Waters, perfectly to resemble them in taste.

Most of the re-agents used on the natural waters, were repeated on these, and with like effects. Here then is a clear proof of the success of the analysis; for synthesis, or the re-composition of a substance, with similar ingredients to what were obtained from it, is the surest evidence of the correctness of an analysis.

Notwithstanding I have not had an opportunity of trying the effects of this water in many diseases, yet it being composed of the same ingredients as the natural waters, leaves no doubt but that it must possess the same medicinal virtues.

CONSIDERATIONS
UPON THE USE
OF
ARTIFICIAL MINERAL
WATERS

AS PREPARED IN THIS CITY :

*Both as a Remedy in Diseases and as
an Ordinary Drink.*

SINCE the first publication of this account of the Waters of Saratoga, and of making Artificial Waters similar to them, a number of Artificial Fountains have been established in this city, furnishing a plentiful supply of these and several other Mineral Waters ; and they appear, as far as the taste can discover, (for

I have not analysed them) to be tolerably well imitated.

As a REMEDY in DISEASES can we calculate as much upon them as upon the Natural Waters at the Springs? In *calculous complaints* I see no reason why we may not; indeed upon some considerations I should prefer them: our citizens may take them without being exposed to the injurious jolting of a jaunt to Saratoga; they may be accommodated comfortably in the quiet of home, in the bosom of their friends, and may have the different materials in the waters varied, as their complaints may require*. As a *vermi-*

* It is presumed however, that if any variation should be made in the composition of the water, so as to meet the particular complaints

fuge we may look for as much advantage from the artificial as from the natural mineral waters ; and as in this instance it is upon the carbonic acid in them, that we chiefly rest our hopes, perhaps the artificial waters may here also be entitled to a preference. Certainly, by means of pressure, a much greater proportion of this acid may be made to combine with water, than the natural mineral waters contain.

In some other complaints they may be of equal efficacy with the

of individuals, that that variation will be made known to those who may take it. It would be an unwarrantable imposition to dispense an Artificial Mineral Water, under the name of an Established Natural Water, unless it be as nearly like it, as the composer's art would enable him to make.

natural waters ; but in cases where general bathing in them becomes necessary, the artificial waters must be out of the question.

That they may be usefully taken in *Dyspepsia* there can be but little doubt ; but we should recollect what has been before observed under that article, that the advantage to be gained, depends in considerable degree upon the exercise and change of air, incumbent upon a visit to the Springs. Hence then this class of invalids ought not to be disappointed, if they should not be as much benefited by the *artificial*, as they may have had reason to believe that they would be, by the *natural* waters at Saratoga.

In *Scrofulous affections*, bathing and

the exercise, change of air, &c. attendant upon an excursion to Ballston, are of material consequence: drinking the waters, of itself, will have its use; but Scrofula is not a trifling complaint, easily to be managed; it requires the united operation of a variety of means to remove it.

As an ORDINARY DRINK, these waters have become very fashionable, and as

“ Fashion in every thing bears solemn sway,
And founts and public haunts have each their
day,”

so they most probably will, for a time, continue to be the favourite beverage of the season; but whether judiciously so, or not, remains to be determined.

From observations delivered in the foregoing pages, it would appear that the Waters of Saratoga and Ballston possess active *medicinal* qualities, oftentimes very usefully employed, not for *them that be whole who need not a physician*, (no medicines) *but for them that are sick*. If they are active medicines, they must be unfit, as an ordinary drink, for persons in health. Nevertheless, if from a multitude of evils we were forced to make a choice, I should not hesitate in giving them a preference to many of the beverages too frequently indulged in during the heat of summer, in this city, as brandy and water, lemonade, lime punch, &c. I believe the *carbonic acid* to be much more

grateful and bracing to the stomach than the *citric*. Were I to recommend any Mineral Water as a common drink, it would not be the Ballston, the Soda nor the Seltzer, but the simply *carbonated*, i. e. water impregnated with fixed air alone, uncombined with any saline, earthy or metallic matter whatever.

We can hardly believe that that which the stomach loathes, and the palate rejects with disgust, can be proper for persons in health: all alkalies are nauseous, and it is not improbable but that they may intercept, by their decomposing chemical powers, the important process of digestion. It is very true that the alkaline taste of the soda water is very much covered by its

superfuration with the carbonic acid, and becomes thereby reconciled to the *palate*, and thus passes by this garde-du-corps, unexamined, into the stomach: but an enemy in the citadel, is none the less so for having gained admittance in disguise. Sweetening a potion does not destroy its power.

The carbonic acid, however, seems free from all these objections: it is found in greater or less proportions in most of the ordinary spring and well waters, and is what chiefly constitutes their life and briskness: water saturated with it, is grateful to the palate and pleasant upon the stomach: the weakness of its chemical affinities, leaves not much to apprehend from its de-

ranging the assimilating operations of digestion : it is cordial, antiseptic and exhilarating.

There is, however, a class of the community, for whom I feel a near sympathizing interest, who cannot too cautiously avoid having any thing to do with this or either of the other of these waters : I mean those of weak lungs, those who are consumptively disposed : the uniform opinion of physicians, concurring with general observations, has been fully confirmed by my own personal experience, that such drinks are highly prejudicial to persons of this description.

FINIS.

THE HISTORY OF THE

PROGRESS OF THE
ART OF PRINTING

IN GREAT BRITAIN
FROM THE FIRST INTRODUCTION
OF THE ART, TO THE PRESENT
STATE OF THE ART, AND THE
MANNER OF IMPROVING IT.

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LONDON:
PRINTED BY J. WELLS, ESQ.
OF THE MIDDLE TEMPLE, ESQ.
OF THE BARR, ESQ.
OF THE BARR, ESQ.

1791.
PRINTED BY J. WELLS, ESQ.
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